IN THE CLAIMS:

1. A compound comprising:

$H_xCs_{(4-x)}Ge_4S_{10}\cdot yH_2S\cdot zH_2O$, $H_xRb_{(4-x)}Ge_4S_{10}\cdot zH_2O$ or $H_xK_{(4-x)}Ge_4S_{10}\cdot zH_2O$,

wherein

$0 < x \leq 4$;

$0 \leq y \leq 1$; and

$z \geq 0$.

2. The compound of claim 1 wherein $x = 4$.

3. The compound of claim 1 wherein $z = 0$.

4. The compound of claim 3 comprising a compound having a double-decker structural unit

5. The compound of claim 4 wherein the double-decker compound is $H_2Ge_4S_9$.

6. The compound of claim 3 comprising a compound having an adamantane-like structural unit.

7. The compound of claim 6 wherein the adamantane-like compound is $H_4Ge_4S_{10}$.

8. The compound of claim 1 wherein $z > 0$.

9. The compound of claim 8 comprising a compound having a double-decker structural unit

10. The compound of claim 9 wherein the double-decker compound is $H_4Ge_4S_{10}{\cdot}xH_20$ wherein $0 < x < 9$.

11. The compound of claim 8 comprising a compound having an adamantane-like structural unit.

12. The compound of claim 11 wherein the adamante compound is $H_4Ge_4S_{10}{\cdot}xH_20$ wherein $0 < x < 9$.

13. The compound of claim 1 wherein the proton conductivity is between about 10^{-8} S/cm and 10^{-1} S/cm within a temperature range of between about -50 and 500 °C.

14. A compound comprising:

$H_xMoS_{2+x/2+z}$,

wherein

$1 \leq x \leq 2$; and

$0.5 \leq z \leq 1$.

15. The compound of claim 14 comprising a thiomolybdic acid.

16. The compound of claim 15 wherein the thiomolybdic acid is anhydrous or hydrated.

17. The compound of claim 14 wherein the thiomolybdic acid is an anhydrous thiomolybdic acid having a conductivity value of 10^{-8} S/cm and 10^{-1} S/cm within a temperature range of between about -50 and 500 °C.

18. A method comprising:

reacting liquid H_2S, H_2Se or H_2Te with a precursor selected from the group consisting of chalcogenides, halides, and any combination thereof, to produce a protonated chalcogenide or unprotonated crystalline sulfide, selenide or telluride..

19. The method of claim 18 wherein the precursor is selected from the group consisting of an oxide, sulfide, hydroxide, fluoride, chloride, iodide, bromide, and any combination thereof, to produce a thio-acid, a hydrosulfide or a sulfide.

20. The method of claim 18 wherein the reacting step occurs in a closed one-end tube located inside a reaction vessel.

21. The method of claim 20 wherein the reaction vessel has a reusable sealing mechanism.

22. The method of claim 20 further comprising:

placing the precursor in the reaction vessel;
drawing a vacuum inside the reaction vessel;
cooling the reaction vessel;
filling the reactor with the H_2S, H_2Se or H_2Te gas;
allowing the H_2S, H_2Se or H_2Te gas to liquefy and/or solidify; and
allowing the reaction to proceed wherein the protonated chalcogenide or unprotonated sulfide, selenide or telluride is produced.

23. The method of claim 22 wherein the reaction vessel is cooled to below about -60 °C.

24. The method of claim 22 further comprising opening the reactor inside an oxygen and water free glove box after the reaction is complete.

25. The method of claim 24 further comprising thermally mixing the protonated chalcogenide with other chalcogenide materials in an evacuated silica tube to produce a glass, ceramic or a glass/ceramic membrane material.

26. The method of claim 25 wherein the protonated chalcogenide is a thio-acid or hydrosulfide which is mixed with other sulfide materials.

27. The method of claim 24 wherein a glass material is produced by combining two or more of the chalcogenides.

28. The method of claim 24 wherein a ceramic material is produced by combining two or more of the chalcogenides.

29. The method of claim 24 wherein a glass/ceramic material is produced by combining two or more of the chalcogenides.

30. The method of claim 24 further comprising reacting the glass, ceramic or glass/ceramic material with liquid H_2S, H_2Se or H_2Te to produce a chemically and thermally stable membrane material.

31. A method for producing a chemically and thermally stable membrane material comprising:

providing a glass phase, ceramic phase or glass/ceramic phase material; and

allowing the glass phase, ceramic phase or glass/ceramic phase material to protonate in liquid H_2S, H_2Se or H_2Te to produce a chemically and thermally stable membrane material.

32. The method of claim 31 wherein the glass phase, ceramic phase or glass/ceramic phase material is a chalcogenide.

33. The method of claim 32 wherein the chalcogenide is selected from the group consisting of oxide, sulfide and oxysulfide.

34. A chemically and thermally stable membrane comprising a glass material, ceramic material or glass/ceramic material adaptable for use in a fuel cell at a temperature of between about -60 °C and 700 °C, the material having a proton conductivity of between about 10^{-6} to 10^{-1} S/cm.

35. The membrane of claim 34 wherein the temperature is greater than 100 °C and less than about 500 °C.